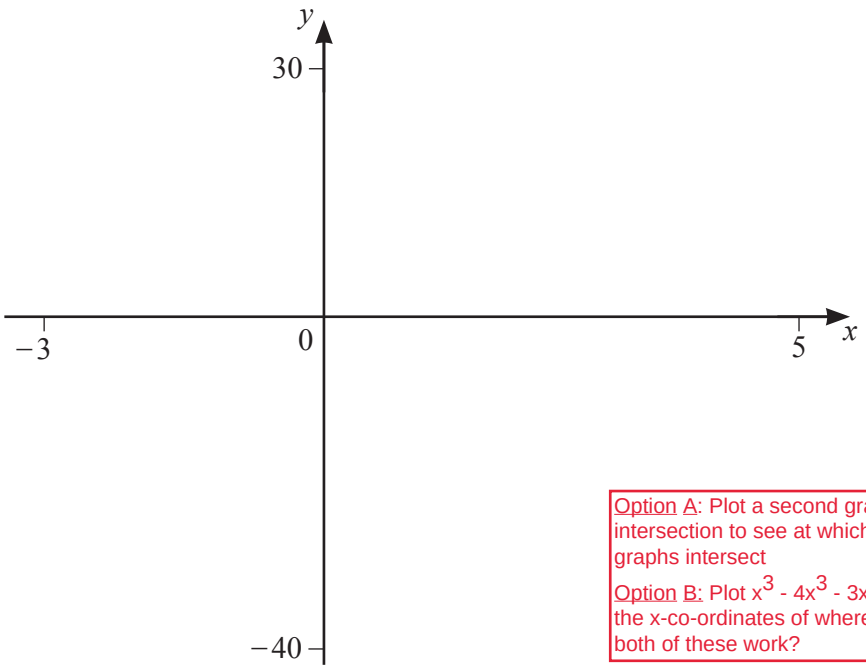
1.



Option A: Plot a second graph of y = 10, use Fcn intersection to see at which x co-ordinates the graphs intersect

Option B: Plot $x^3 - 4x^3 - 3x + 8$, use Fcn root to see the x-co-ordinates of where it cuts x axis... why do both of these work?

$\mathrm{f}(x) = x^3 - 4x^2 - 3x + 18$ Plot on GDC

(a) On the diagram, sketch the graph of $y = \mathrm{f}(x)$ for $-3 \leqslant x \leqslant 5$. [2]

(b) Solve the equation $\mathrm{f}(x) = 10$.

$x =$ ..... , or $x =$ ..... , or $x =$ ..... [3]

(c) Write down the coordinates of

(i) the local maximum,

Turning point - maximum (top of a hill)

(..... , ...) [2]

(ii) the local minimum.

Turning point - minimum (bottom of a valley)

(..... , ...) [1]

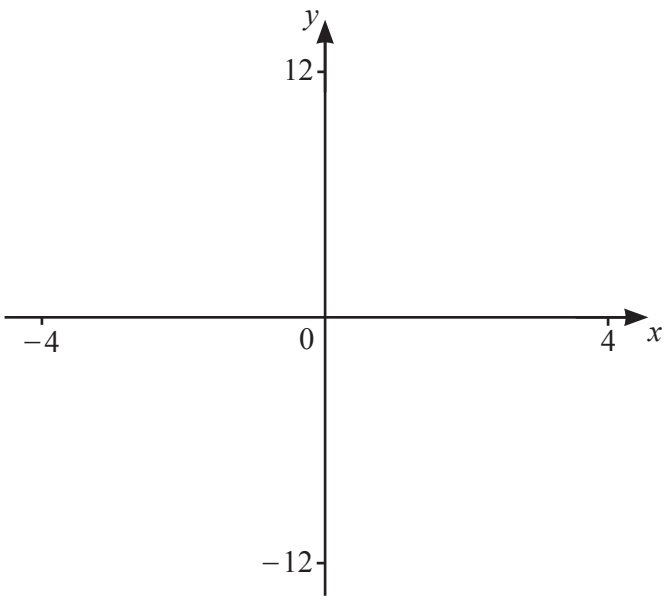
(d) $\mathrm{f}(x) = k$ has only 1 solution.

Find the ranges of values of k.

If you were to draw a horizontal line of y = a number, which numbers could you use that it only cuts graph once?

..... [2]

2.



$f(x) = |4 - x^2|$ for $-4 \leqslant x \leqslant 4$

(a) On the diagram, sketch the graph of $y = f(x)$. [2]

(b) Write down the zeros of $f(x)$.

Where it cuts the x axis

..... [2]

(c) Write down the coordinates of the local maximum.

(..... , ...) [1]

(d) The equation $|4 - x^2| = k$ has 4 solutions and k is an integer.

Write down a possible value of k.

$k =$ ..... [1]

(e) **(i)** On the diagram, sketch the graph of $y = 2x$. [1]

(ii) Solve the equation $|4 - x^2| = 2x$.

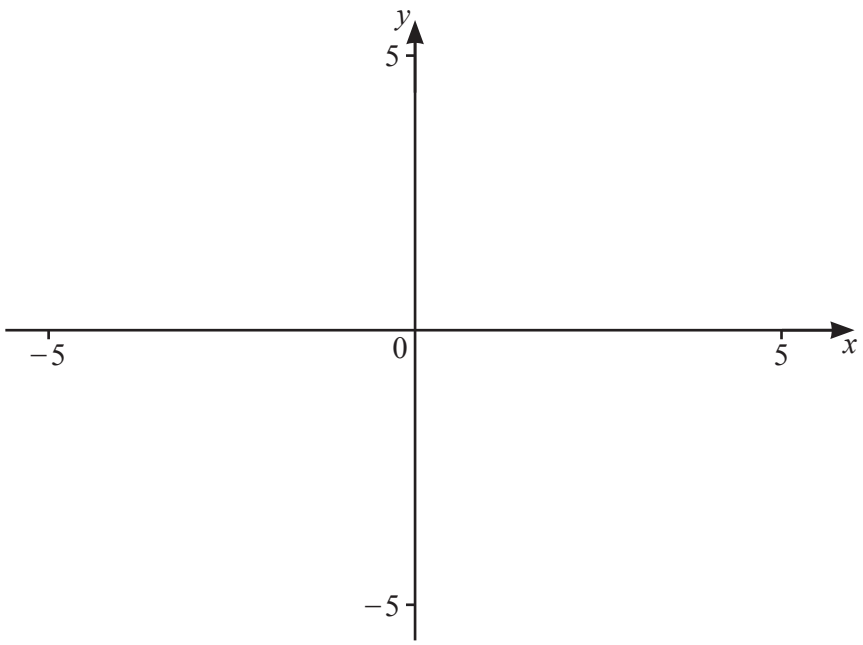
Solve means, give the x values for where the two graphs intersect

..... [2]

(iii) On the diagram, shade the regions where $y \geqslant 0$, $y \leqslant 2x$ and $y \leqslant |4 - x^2|$. [2]

AND means all three need to be true!

3.



$$f(x) = \frac{x^2 + 3}{(1 - x)(x + 3)}$$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -5 and 5. [3]

(b) Find the equations of the asymptotes parallel to the y-axis.

Asymptote, line which the graph will approach, however never cut or cross

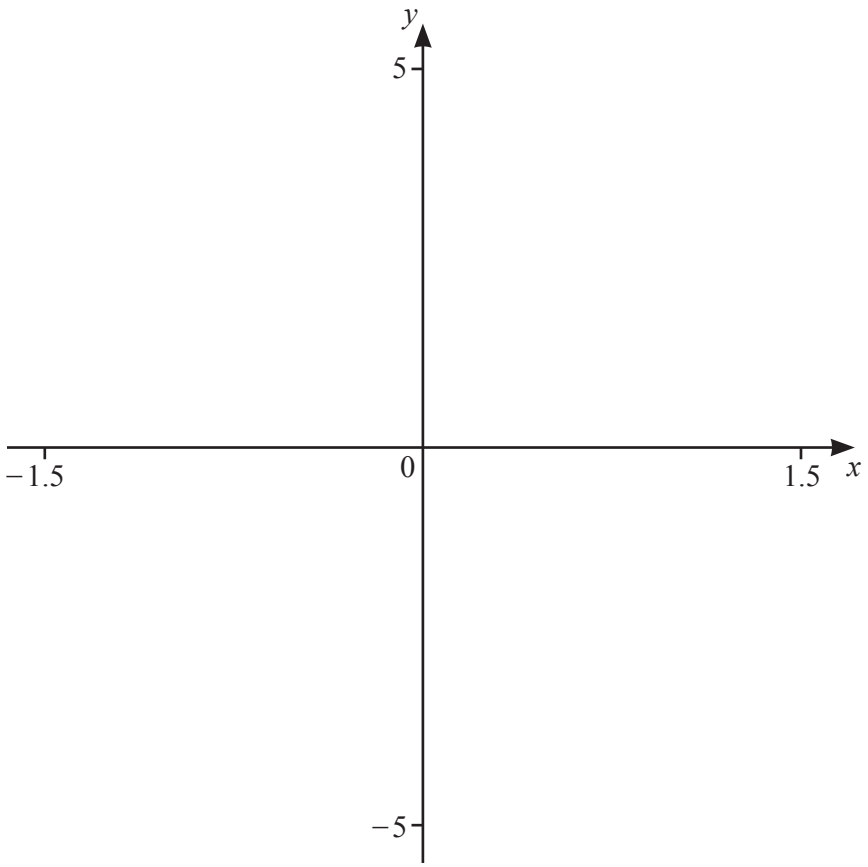
..... [2]

(c) Solve $f(x) = 2x + 3$.

Draw in second graph and see where the two graphs intersect

..... [3]

4.



$$f(x) = \left| x^3 - \frac{1}{x} \right|$$

(a) On the diagram, sketch the graph of $y = f(x)$, for values of x between -1.5 and 1.5. [3]

(b) Write down the equation of the asymptote of the graph.

..... [1]

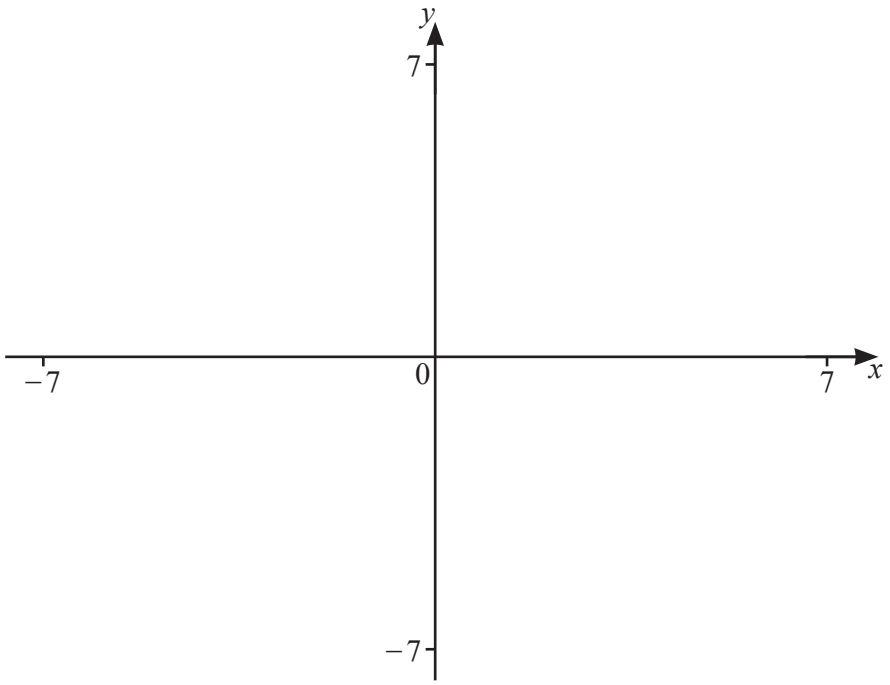
(c) Solve the equation $f(x) = 2$ for values of x between -1.5 and 0.

$x =$ ..... or $x =$ ..... [2]

(d) Solve the inequality $f(x) + x^2 \leqslant 2$ for values of x between -1.5 and 1.5.

..... [3]

5.



$$f(x) = \frac{(2x^2 + 3)}{(x+1)(2-x)} \quad \text{for } -7 \leqslant x \leqslant 7$$

(a) On the diagram, sketch the graph of $y = f(x)$. [3]

(b) Write down the equation of each asymptote parallel to the y-axis.

..... [2]

(c) Write down the coordinates of the local minimum.

(..... , ...) [2]

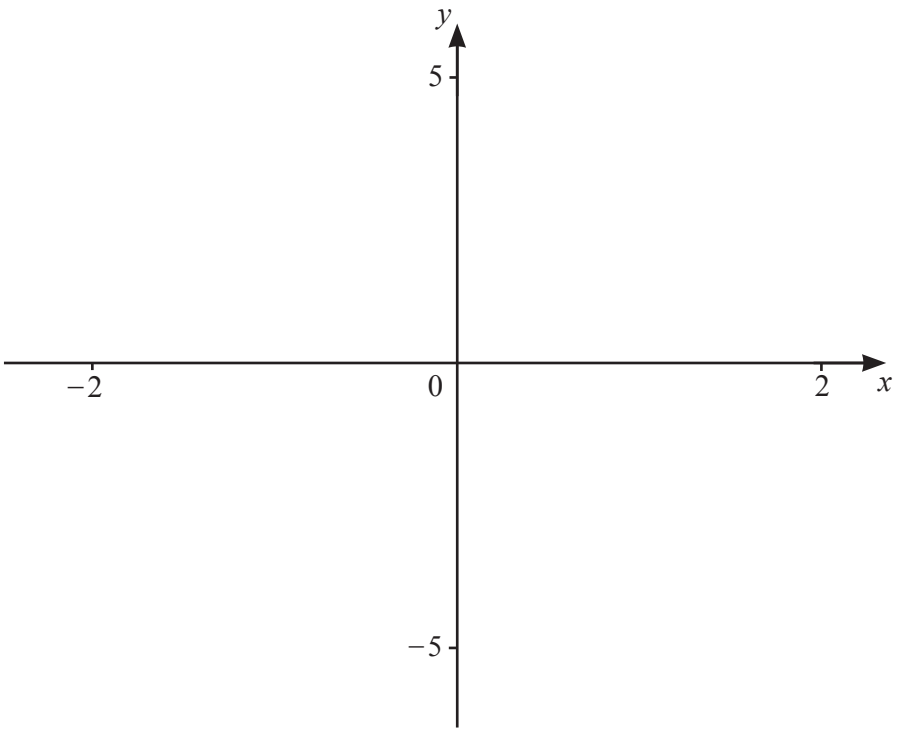
(d) Find the range of values of x for which the gradient of $f(x)$ is negative.

..... [3]

(e) Solve $f(x) = -x$.

$x =$ ..... [1]

6.



$f(x) = 3x - x^3$ for $-2 \leqslant x \leqslant 2$

(a) On the diagram, sketch the graph of $y = f(x)$. [2]

(b) Find the coordinates of the local maximum.

(..... , ...) [1]

(c) Write down the x-coordinates of the points where the curve meets the x-axis.

$x =$ ..... , $x =$ ..... , $x =$ ..... [2]

(d) **(i)** Describe fully the **single** transformation that maps $y = f(x)$ onto $y = f(x+1)$.

.....

.....

Plot a second graph
$3(x+1) - (x+1)^3$ and describe how you can move the first graph to be where the second graph is

[2]

(ii) Solve $f(x) = f(x+1)$ for $-2 \leqslant x \leqslant 2$.

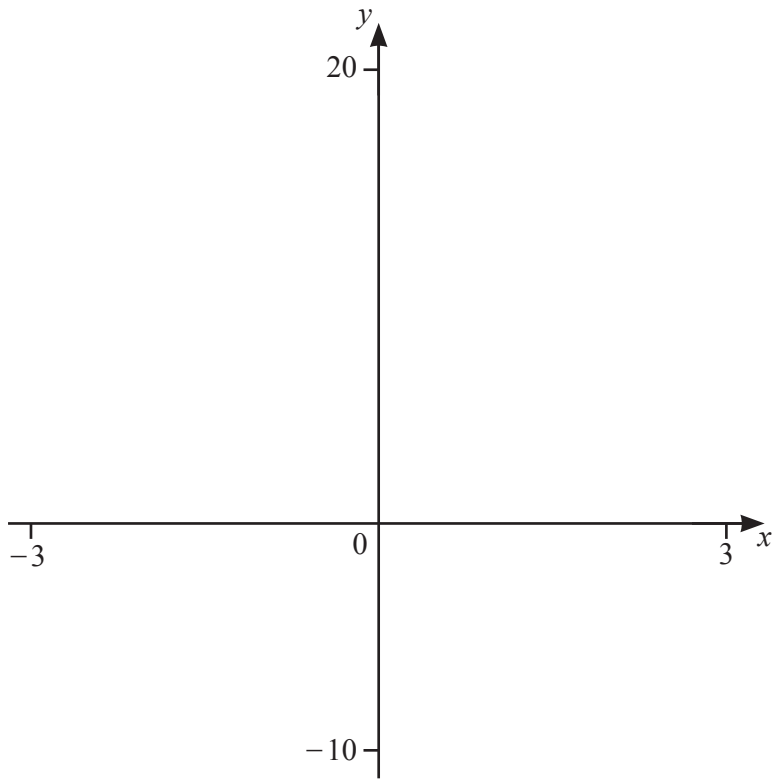
..... [2]

(iii) Solve $f(x) \geqslant f(x+1)$ for $-2 \leqslant x \leqslant 2$.

What are the x values when the first graph has a higher y value co-ordinate (on top?) of the second graph

..... [2]

7.



$f(x) = x^3 - 5x + 3$ for $-3 \leqslant x \leqslant 3$

(a) On the diagram, sketch the graph of $y = f(x)$. [2]

(b) Find the coordinates of the local maximum.

(..... , ...) [2]

(c) Describe fully the symmetry of the graph of $y = f(x)$.

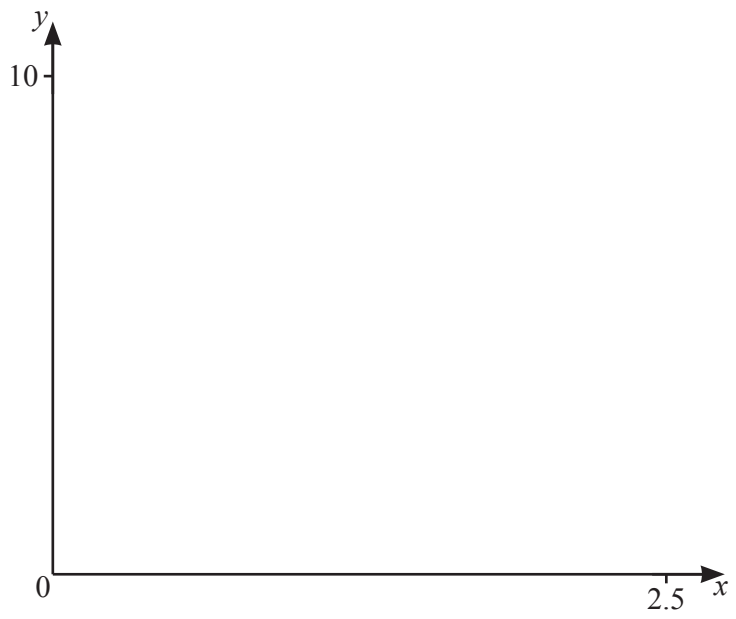
.....

..... [3]

(d) Find the zeros of the graph of $y = f(x)$.

..... [3]

8.



$f(x) = x^x$, $x > 0$

(a) On the diagram, sketch the graph of $y = f(x)$ for $0 < x \leqslant 2.5$. [2]

(b) Find the coordinates of the local minimum point.

(..... , ...) [2]

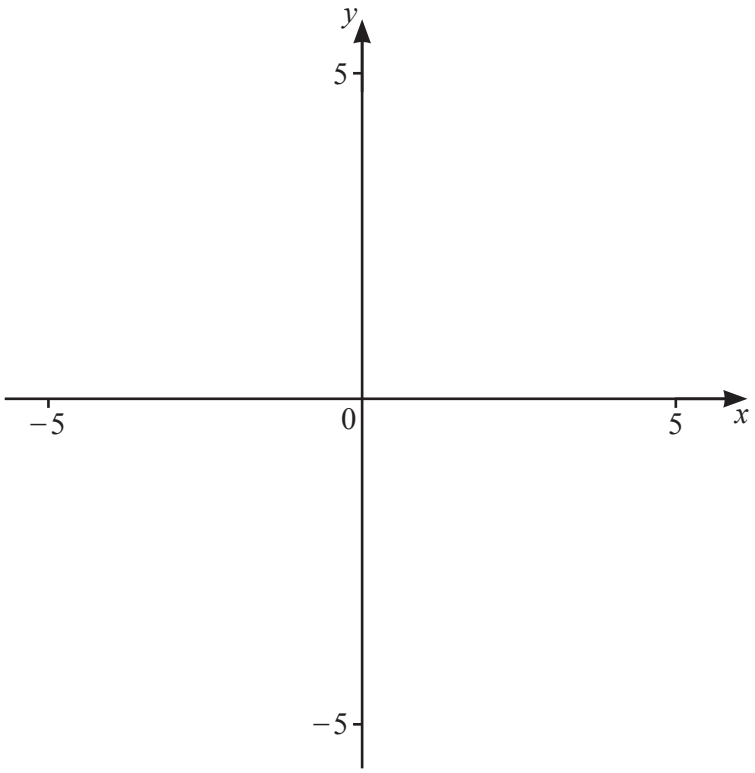
(c) **(i)** Find x when $f(x) = 3x$.

..... [3]

(ii) Solve $f(x) \geqslant 3x$.

..... [2]

9.



$f(x) = x - \frac{4}{x}$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -5 and 5. [2]

(b) Find the zeros of $f(x)$.

$x =$ ..... or $x =$ ..... [2]

(c) Solve the equation $f(x) = 2$.

$x =$ ..... or $x =$ ..... [2]

(d) $g(x) = f(x + 2)$

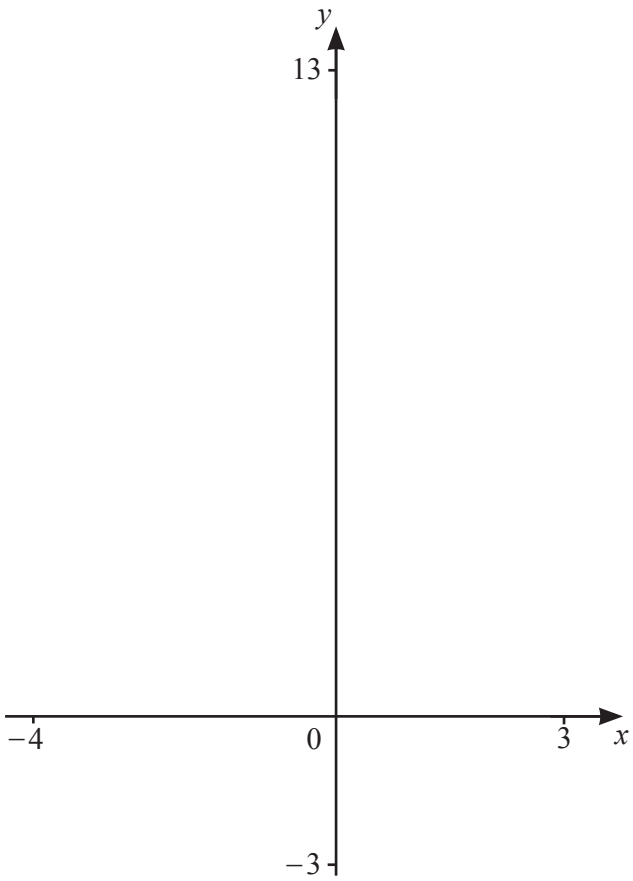
(i) On the same diagram, sketch the graph of $y = g(x)$ for values of x between -5 and 5. [2]

(ii) Describe fully the **single** transformation that maps the graph of $y = f(x)$ onto the graph of $y = g(x)$.

.....

..... [2]

10.



$g(x) = \frac{1}{x-2}$, $x \neq 2$

(a) On the diagram, sketch the graph of $y = g(x)$ for values of x between -4 and 3. [3]

(b) Write down the equations of the asymptotes of the graph of $y = g(x)$.

.....

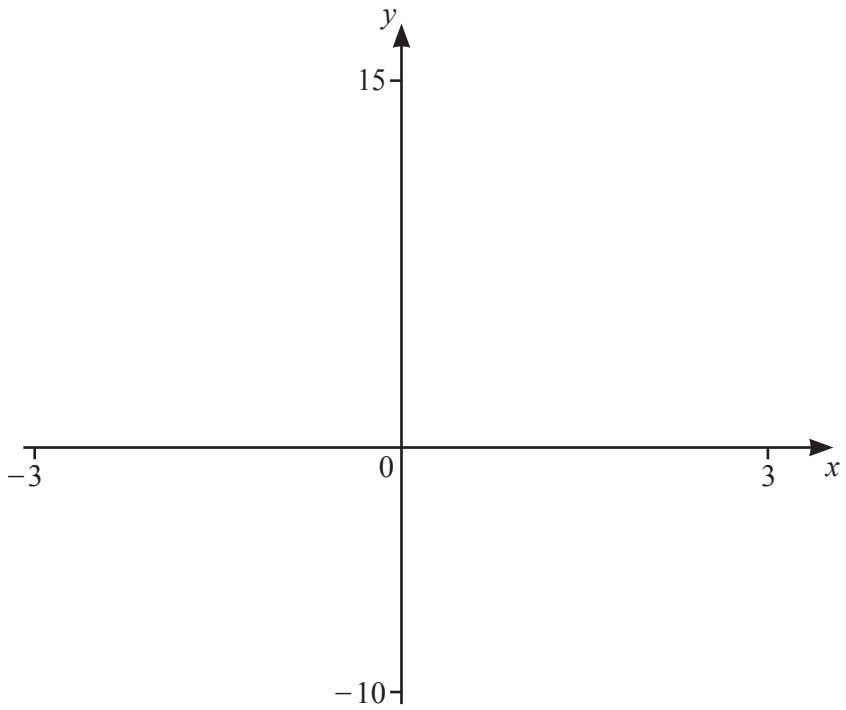
..... [2]

(c) $h(x) = (x+1)^2 - 3$

Solve the inequality $g(x) > h(x)$.

..... [4]

11.



$f(x) = x^3 - 5x + 3$ for $-3 \leqslant x \leqslant 3$

(a) On the diagram, sketch the graph of $y = f(x)$. [2]

(b) Find the coordinates of the local minimum point.

(..... , ...) [2]

(c) Describe fully the symmetry of the diagram.

.....

..... [3]

(d) $g(x) = 2x - 1$

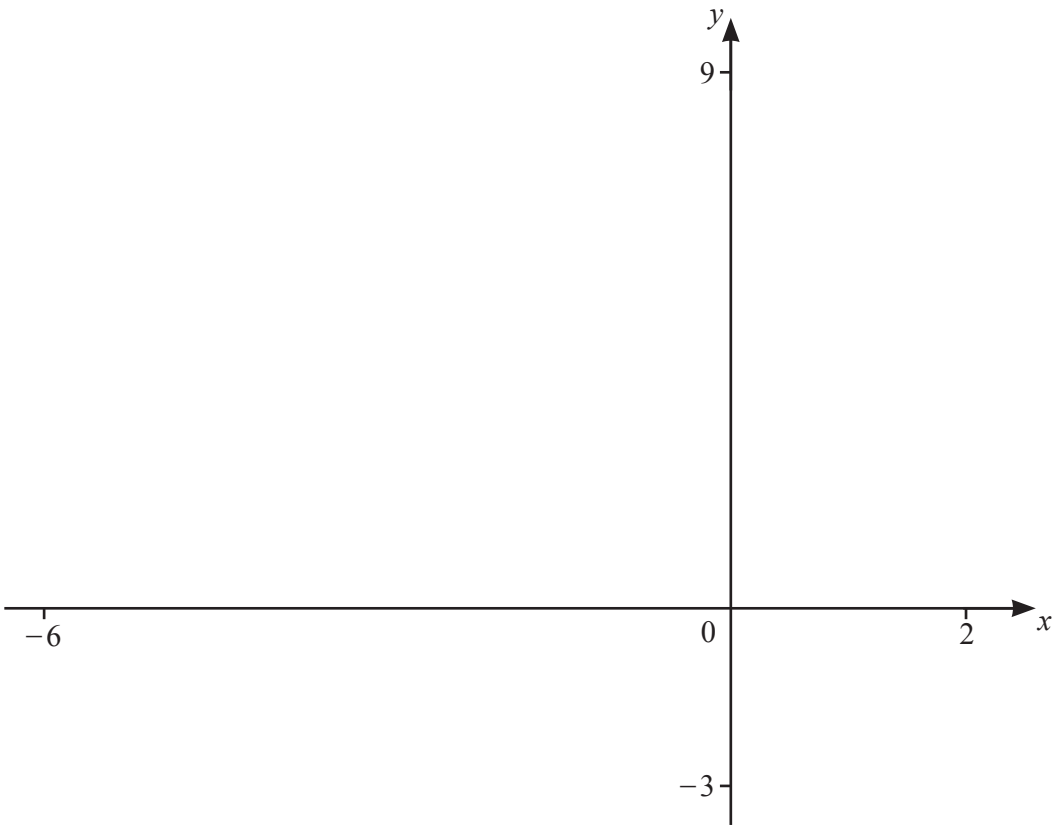
(i) Solve $f(x) = g(x)$ for $-3 \leqslant x \leqslant 3$.

..... , ... , ... [3]

(ii) Use your answers to **part(i)** to solve $f(x) > g(x)$.

..... [2]

12.



(a) $f(x) = 2 + \frac{1}{x+2}$

(i) On the diagram, sketch the graph of $y = f(x)$ for values of x between -6 and 2. [2]

(ii) Write down the coordinates of the points where the graph crosses the axes.

(..... , ...) and (..... , ...) [2]

(iii) Write down the equations of the asymptotes of the graph.

..... , ... [2]

(b) $g(x) = (x+4)^2$

On the diagram, sketch the graph of $y = g(x)$ for $-6 \leqslant x \leqslant -1$. [2]

(c) Solve the equation.

$f(x) = g(x)$

..... [3]

(d) Solve the inequality.

$f(x) \geqslant g(x)$

..... [2]

13. (a)

(i) On the diagram, sketch the graph of $y = |\log x|$ for $0 < x \leqslant 5$. [2]

(ii) Solve the equations.

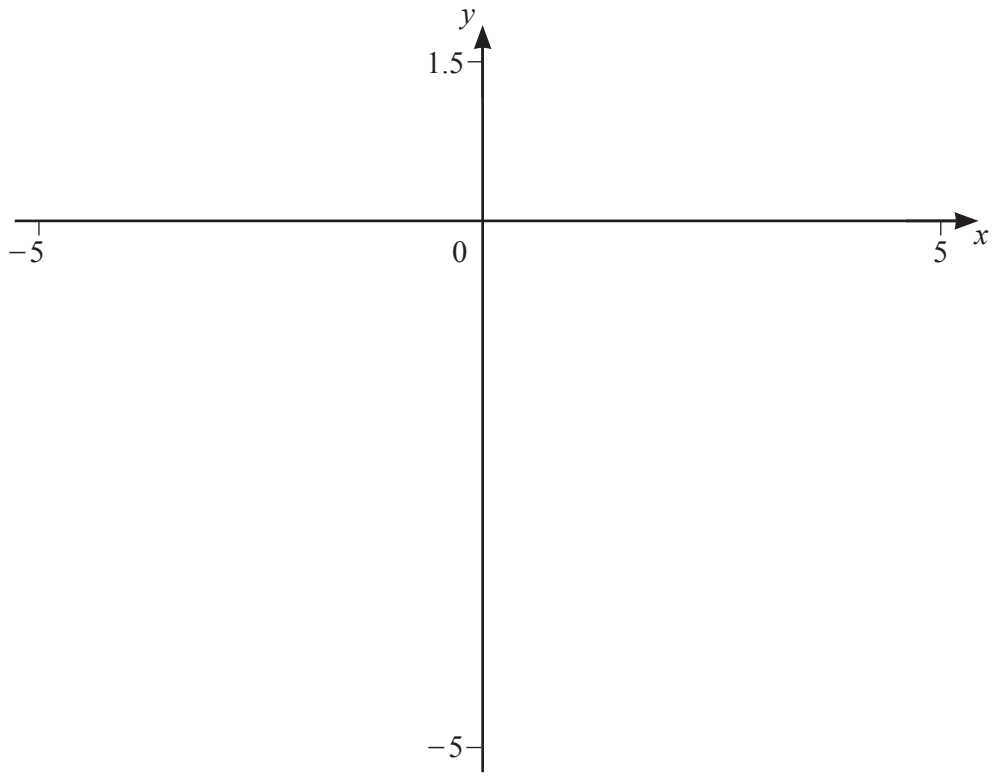
(a) $|\log x| = 0.2$

$x =$ ..... or $x =$ ..... [2]

(b) $|\log x| = 1 - \frac{x}{4}$

$x =$ ..... or $x =$ ..... [4]

(b)



(i) On the diagram, sketch the graph of $y = \log|x|$ for values of x between -5 and 5. [2]

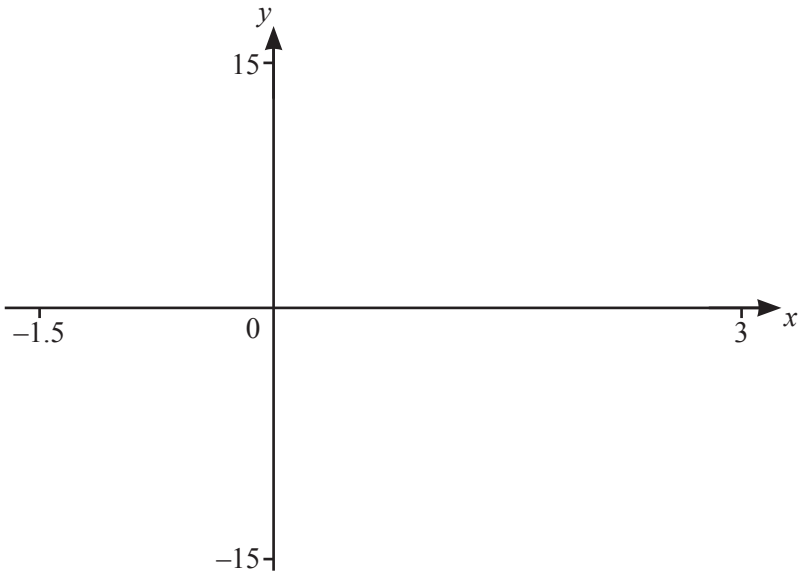
(ii) Solve the equation $\log|x| = 0.2$.

$x =$ ..... or $x =$ ..... [2]

(c) Write down the range of values of x for which the graph of $y = |\log x|$ is the same as the graph of $y = \log|x|$.

..... [1]

14.



$f(x) = 2x^3 - 5x^2 + 3$ for $-1.5 \leqslant x \leqslant 3$

(a) On the diagram, sketch the graph of $y = f(x)$. [2]

(b) Find the zeros of $f(x)$.

..... [3]

(c) Find the co-ordinates of the local maximum.

(..... , ...) [1]

(d) Find the co-ordinates of the local minimum.

(..... , ...) [2]

(e) The equation $2x^3 - 5x^2 + 3 = k$ has three solutions.

Find the range of values of k.

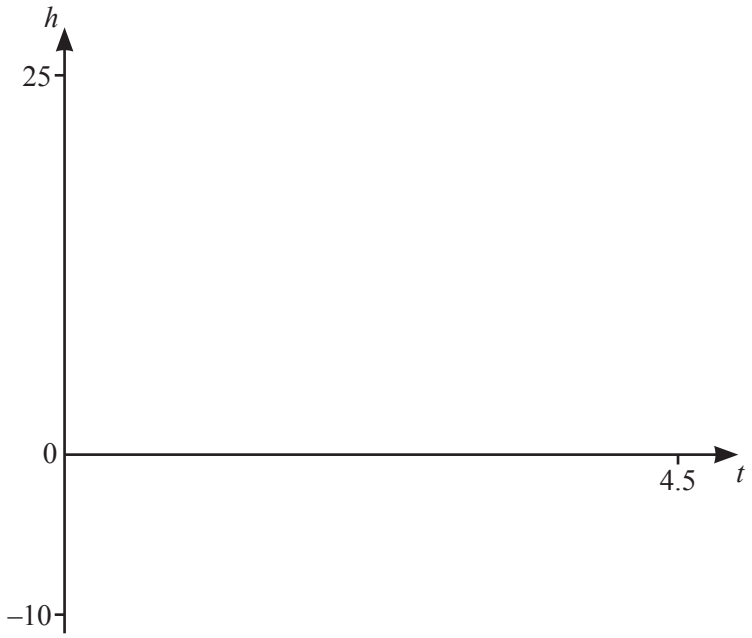
..... [2]

15. A stone is thrown vertically upwards from ground level.
Its height, h metres above ground level, after t seconds, is given by $h = 20t - 4.9t^2$.

(a) Find the height of the stone after 1 second.

..... m [1]

(b) **(i)** On the diagram, sketch the graph of $h = 20t - 4.9t^2$ for $0 \leqslant t \leqslant 4.5$.



[2]

(ii) Complete the statement.

The maximum height reached by the stone is ..... m when t = ... s.
[2]

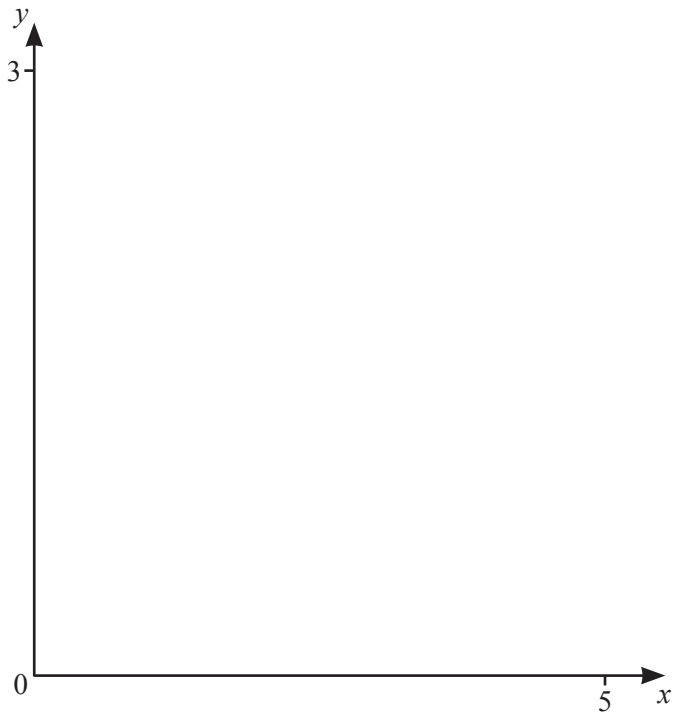
(iii) Find the length of time the stone is in the air before it hits the ground.

..... s [1]

(iv) Find the length of time the stone is more than 18 m above ground level.

..... s [3]

16.



(a) On the diagram, sketch the graph of $y = \log\left(\frac{x+1}{x}\right)$ for $0 < x \leqslant 5$. [2]

(b) Write down the equations of the asymptotes to the graph of $y = \log\left(\frac{x+1}{x}\right)$.

.....

..... [2]

(c) Solve the equation $\log\left(\frac{x+1}{x}\right) = 0.5$.

$x =$ ..... [1]

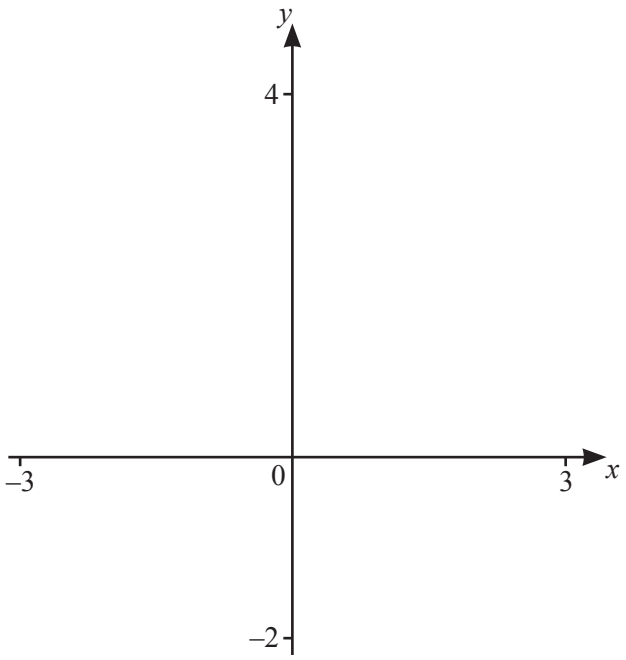
(d) On the same diagram, sketch the graph of $y = \frac{x}{2}$ for $0 < x \leqslant 5$. [1]

(e) Solve the equation $\log\left(\frac{x+1}{x}\right) = \frac{x}{2}$.

$x =$ ..... [1]

(f) On your diagram, shade the region where $y \leqslant 0.5$, $y \geqslant \frac{x}{2}$ and $y \geqslant \log\left(\frac{x+1}{x}\right)$. [1]

17.



$$f(x) = \frac{1}{(1-x^3)}, \quad x \neq 1$$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -3 and 3. [3]

(b) Write down the range of $f(x)$ for $-3 \leqslant x \leqslant 0$.

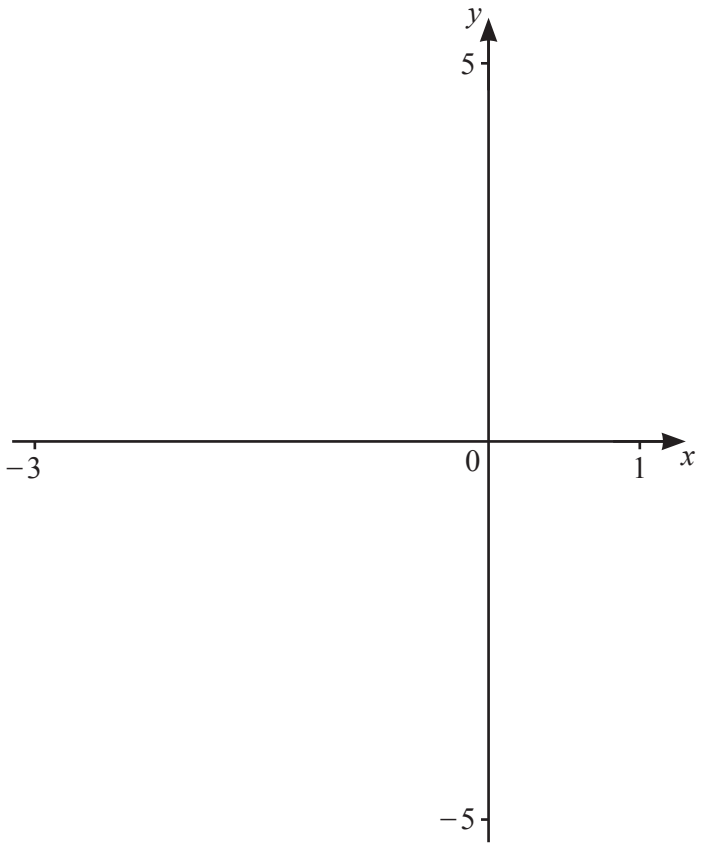
..... [2]

(c) On the same diagram, sketch the graph of $y = x^2$ for $-2 \leqslant x \leqslant 2$. [1]

(d) **(i)** Solve the equation $\frac{1}{1-x^3} = x^2$.

$x =$ ..... [1]

18.



$$f(x) = 2x + 4 - \frac{1}{x^2}$$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -3 and 1. [3]

(b) Write down the equation of the asymptote of the graph.

..... [1]

(c) Find the coordinates of the local maximum.

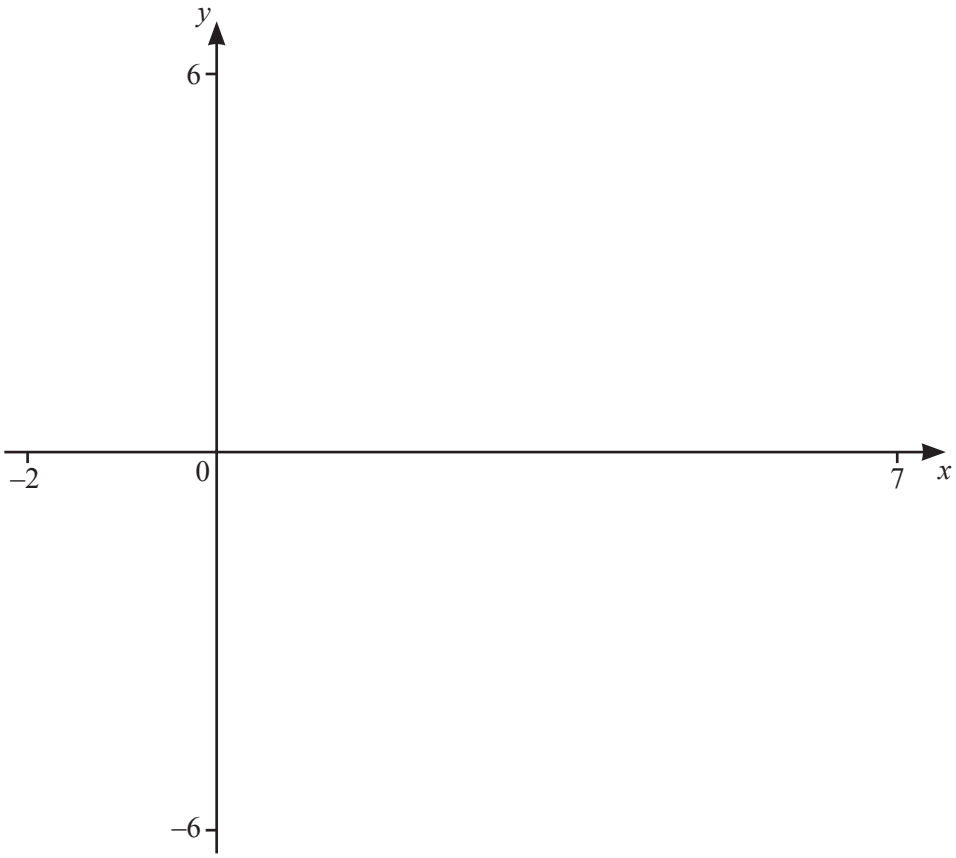
(..... , ...) [1]

(d) $g(x) = x^3 - 5x$ for $-3 \leqslant x \leqslant 1$.

Solve $f(x) \leqslant g(x)$.

..... [4]

19.



$$f(x) = \frac{(x+2)}{(x-1)(x-4)}$$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -2 and 7. [3]

(b) Write down the co-ordinates of the local maximum.

(..... , ...) [2]

(c) Write down the equation of each of the three asymptotes.

..... , ... , ... [3]

(d) $g(x) = x - 5$

(i) Solve the equation $f(x) = g(x)$.

$x =$ ..... or $x =$ ..... or $x =$ ..... [3]

(ii) Solve the inequality $f(x) > g(x)$.

..... [3]